Building 2-66 Floating Product Recovery System Interim Measures Completion Report

Boeing Plant 2
Seattle/Tukwila, Washington

Submitted To:
The Boeing Company
Seattle, WA

February 28, 2003

Plant 2 Remediation

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WESTON SOLUTIONS

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Submitted by

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SECTION 1

INTRODUCTION

This Interim Measures Completion Report presents a summary of the work completed to remove light non-aqueous phase liquid (LNAPL, diesel) located on the water table near the southwest corner of former Building 2-66. This Report also provides the rationale for terminating the recovery system at this time. Historical and current product thickness measurement and recovery data are presented to show that the system has met its goals, and additional removal of residual LNAPL using this system is no longer practicable.

SECTION 2

BACKGROUND

LNAPL was initially discovered at the site during the installation of monitoring wells in the vicinity of the southwest corner of Building 2-66 in 1992 (Figure 1). Analysis of the LNAPL indicated it was diesel. Over 3 feet of LNAPL was measured in wells PL2-018A and PL2-019A. LNAPL was not present in nearby wells PL2-001A, -011A, -022A, -023A, -024A, and -025A. Well PL2-001A was abandoned in 1994 during the installation of the southwest yard sheetpile interim measure (IM).

An Interim Measures Workplan (WESTON 1994) was developed for removal of the LNAPL. Objectives of the interim measure were:

- Minimize the migration of free product
- Recover free-phase product

An LNAPL recovery system was installed at the site and began operation in February 1995. The system consists of an LNAPL recovery pump installed in a 4-inch diameter recovery well. The pump was designed to remove LNAPL to a thickness of approximately ½ inch. Recovered LNAPL was pumped to a storage tank and periodically removed for disposition. The LNAPL recovery system operated until 17 October 2000, at which time it was shutdown temporarily and dismantled to support building demolition. Over the period of operation, the rate of LNAPL recovery declined (see Figure 2). Approximately 1,300 gallons of LNAPL were removed by the system during its initial 5 ½ years of operation. The system was re-installed following 2-66 building demolition and re-started on 26 February 2002. Approximately 60 gallons of recovered LNAPL has been removed since the system was re-started.

LNAPL thickness surveys were conducted after system shutdown in October 2000 and just prior to re-start in February 2002. LNAPL measurements have also been taken several times since the system was re-started in February to monitor the extent and thickness of remaining LNAPL and to evaluate the effectiveness of the system. The last three measurement events were prompted by low LNAPL recovery. Measurements were conducted at low tides since historic LNAPL accumulation in the wells was generally greatest during this tidal cycle phase. Results of the LNAPL thickness measurements are discussed below. A summary of data from all measurement events is provided in Table 1.

SECTION 3

RECENT LNAPL MEASUREMENT EVENTS

3.1 8 NOVEMBER 2000 EVENT (POST-SYSTEM SHUTDOWN)

LNAPL thickness measurements were performed on 8 November 2000 at higher low tide. This date was selected in order to allow LNAPL to accumulate in the wells for approximately 3 weeks following system shutdown on 17 October 2000. Measurements taken during this event detected LNAPL in the extraction well and well PL2-018A. Well PL2-019A, in which 3.36 feet of LNAPL was measured in 1992, contained no LNAPL. Well PL2-018A, in which 3.41 feet of LNAPL was measured in 1992, contained approximately 1 foot of LNAPL. LNAPL was measured at a thickness of 1.44 feet in the extraction well. No other wells contained measurable LNAPL.

The results of a bail down test conducted during the measurement event indicated that the thickness of the LNAPL at the site was approximately 0.4 feet. Based on this data, continued operation of the system was planned following building demolition.

3.2 12 DECEMBER 2001 EVENT (PRE-SYSTEM STARTUP)

Measurement of LNAPL thickness in the extraction well and surrounding wells (PL2-011A, -018A, -019A, -022A, -023A, -024A, and -025A) was performed again on 12 December 2001 at higher-low tide. These measurements were performed to evaluate LNAPL thickness after a shutdown period of 13 months and just prior to planned system startup. During this event, 2.42 feet of LNAPL was measured in the extraction well; 0.68 feet was measured in PL2-018A; and 1.16 feet was measured in PL2-019A.

A bail down test was also performed due to the thickness of LNAPL measured in the wells. The results of the bail down tests indicated that the thickness of localized LNAPL was approximately 0.4 feet in the vicinity of PL2-019A where it was not observed during post shutdown measurements. This statement is based on accumulation of product in well PL2-019A immediately after the bail down test and a lack of appreciable accumulation in well PL2-018A.

3.3 19 MARCH 2002 EVENT

Periodic product thickness measurements occurred on 19 March 2002 in the wells surrounding the extraction well (PL2-011A, -018A, -019A, -022A, -023A, -024A, and -025A). Measurements were taken at three different time intervals; high tide mid-tide and low tide. The maximum thickness of LNAPL measured was 0.29 feet in PL2-018A and 1.56 feet in PL2-019A. LNAPL thickness was not measured in the extraction well due to operation of the system (i.e., minimal LNAPL was expected to be present in the well). No measurable LNAPL was observed in any of the other wells.

3.4 OCTOBER/NOVEMBER/DECEMBER 2002 EVENTS

The last three measurement events (October/November/December 2002) were conducted to investigate the low LNAPL recovery rate that began approximately in April 2002. Periodic system maintenance ensured that pump functionality was not the cause of low recovery.

LNAPL thickness was measured on 17 October 2002 (at lower-low tide). LNAPL thicknesses of 0.89 feet and 1.05 feet of were measured in wells PL2-018A and –019A respectively. No measurable LNAPL was observed in any of the remaining wells, including the extraction well, which is significant because the recovery pump will remove LNAPL accumulations as thin as ½ inch. The lack of LNAPL in the extraction well, therefore, indicated that the pump was working properly, and no significant LNAPL quantities were flowing to the extraction well.

Two additional measurement events were conducted on 20 November (at higher-low tide) and 2 December 2002 (at lower-low tide). During these events, only wells PL2-018A and –019A were measured because they were the only wells in which LNAPL was observed during the March and October 2002 events. The extraction well was not measured because the recovery pump kept the thickness in that location to a minimum, and because negligible volumes were recovered as waste product during this period. During the November and December events, no measurable LNAPL was observed in either well PL2-018A or –019A. This repeated observation indicates that any remaining LNAPL is limited in extent, may not be contiguous, and is no longer recoverable by the recovery pump.

SECTION 4

SUMMARY AND CONCLUSIONS

Table 1 presents a historical summary of LNAPL thickness measured.

Table 1—Product Thickness (feet)[a]

Monitoring Well	GeoEngineers	WESTON					
	1992	November 2000 (shutdown)	December 2001 (startup)	March 2002	October 2002	November 2002	December 2002
PL2-001A	0	0	NP	NP	NP	NP	NP
PL2-011A	0	0	0	0	0	—	—
PL2-018A	3.41	0.84	0.68	0.29	0.89	0	0
PL2-019A	3.36	0	1.16	1.56	1.05	0	0
PL2-022A	0	0	0	0	0	—	—
PL2-023A	0	0	0	0	0	—	—
PL2-024A	0	0	0	0	0	—	—
PL2-025A	0	0	0	0	0	—	—
Extraction Well	NP	1.44	2.42	—	0	—	—

Notes:

a: Maximum thickness measured.

—: Not measured.

NP: Not present.

As shown in Table 1, LNAPL has historically been present only in the vicinity of wells PL2-018A, -019A, and the extraction well. The LNAPL fluctuated somewhat within this area; the first evidence of this was seen during the post-shutdown and pre-startup measurement events. Measurable LNAPL was not observed in PL2-019A during the post-shutdown measurement event but was observed (at a thickness of 1.16 feet) during the pre-startup event. The latest monitoring data show that the LNAPL is not present in recoverable quantities in the area of wells PL2-018A and -019A and the extraction well.

The recovery system equipment was functioning properly throughout the period as determined by periodic inspections and maintenance. The lack of recovered LNAPL over the recovery system's last nine months of operation (April to December 2002) is the result of minimal LNAPL remaining in the area of the extraction well. Although limited quantities of measurable LNAPL likely remain in the area, the LNAPL is no longer effectively removed by the existing recovery system.

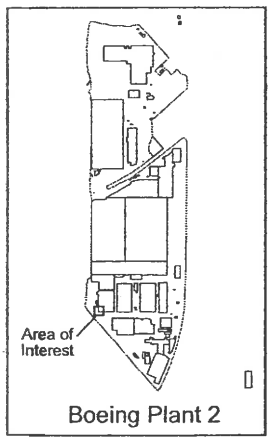
It is recommended, therefore, that the LNAPL recovery system be decommissioned. Remaining LNAPL will be addressed during the upcoming Corrective Measures Study at Plant 2 where other more effective removal/treatment technologies will be evaluated.

SECTION 5

REFERENCES

Roy F. Weston, Inc. (WESTON). 1994. Interim Measures Workplan, Interim Corrective Action Building 2-66, Boeing Plant 2, Seattle/Tukwila, Washington. November.

FIGURES



Building 2-66

PL2-024A

PL2-011A

PL2-019A

PL2-023A

Extraction Well

PL2-018A

PL2-022A

Approximate Location of Sheetpile IM Structure

PL2-001A (abandoned)

PL2-025A

Building 2-66 LNAPL Recovery System Monitoring Well Locations

N

PLANT

0 25 50

Scale in Feet

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Figure 1

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Figure 2—LNAPL Recovery Rate (February 1995 to October 2000)